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• DELVAUX, Roger

B-3010 Kessel-Lo (BE)

• DEMESMAEKER, Marc

B-2020 Antwerpen (BE)

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08.07.1994 GB 9413811

(74) Representative: Benson, John Everett et al

Raychem Limited

Intellectual Property Law Department

Faraday Road

Dorcan

Swindon, Wiltshire SN3 5HH (GB)

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(73) Proprietor: N.V. RAYCHEM S.A.

3010 Kessel-Lo (BE)

(72) Inventors:

• BUEKERS, Valere

B-3545 Zelen-Halen (BE)

(56) References cited:

EP-A- 0 299 797

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Description

The present invention relates to a device for providing environmental protection around electrical connectors, components or circuitry.

In particular, the invention provides a device comprising a network termination module that preferably contains a so-called maintenance termination unit or MTU. Such units are often provided in a telecommunications network between that part which is the responsibility of the telephone company and that part which is the responsibility of the subscriber. The module serves as a demarcation point and allows remotely-activated disconnection and testing.

Such modules generally need to provide protection from the environment in order that they may be positioned in unfavourable locations for example on an external wall of a building. Such environmental protection can prevent moisture or other contaminants from damaging electrical connectors, components and circuitry.

According to a first aspect of the invention, there is provided a device for environmental protection of an electrical component on a mount, which comprises: a first housing part, a second housing part which together with the first housing part provides a closed housing; a mount for an electrical component, that may be movably secured with respect to the first housing part; and a sealing material positioned between the mount and a surface of the first housing part such that the mount can be moved with respect to the first housing part to put the sealing material under compression and to cause displacement of the sealing material to a position where it can form a seal between the first and second housing parts.

The fact that the sealing material may be put under compression by moving the mount with respect to the first housing part has an advantage in that mere movement of the mount may improve the sealing characteristics of the sealing material or it may transform the sealing material from a state in which it can not form an effective seal into a state in which it can form an effective seal. This is particularly applicable to embodiments of the invention which use gel or a gel-like substance as the sealing material, since such materials often perform best when they are placed under compression. Such compression may, advantageously, be applied to the sealing material in a way which accommodates creepage due to temperature fluctuations or due to the applied compression itself, while keeping the sealing material under compression. For example, one or more resilient biasing means, e.g. springs, may be provided, or such resilient biasing may be provided by the material of the housing or by the mount for the electrical component.

As already mentioned, the movement of the mount with respect to the first housing part causes displacement of sealing material to a position where it can form a seal between the first and second housing parts. This has an advantage in that the formation of the seal be-

tween the first and second housing parts may occur substantially automatically upon movement of the mount with respect to the first housing part. This may, for example, enable the sealing material to be retained in a position in which it is protected from damage or contamination while a technician works on the mount and only to be displaced into a sealing position when the device is re-closed. More preferably, the displacement of the sealing material comprises formation of a bead of sealing material between a wall of the first housing part and the mount. Most preferably, the sealing material is displaced such that a substantially continuous bead of material is formed around the mount, between the mount and a wall of the first housing part which may be contacted by the second housing part to form a continuous seal between the first and second housing parts.

The mount for an electrical component preferably comprises a circuit board, especially a printed circuit board.

According to a preferred embodiment of the invention, the device further comprises one or more supports for the mount, which project from the said surface of the first housing part, the supports being constructed to allow the mount to be moved with respect to, preferably towards, and more preferably towards and away from, the said surface of the first housing part to put the sealing material under compression. The support or supports may, for example, advantageously prevent lateral movement (including rotation) of the mount with respect to the first housing part which could otherwise prevent the formation of a continuous bead around the mount and hence reduce the effectiveness of the seal. Preferably the support(s) project(s) through the sealing material. Preferably the device comprises one or more stop means to limit the movement of the mount towards the said surface of the first housing part. Each support may advantageously comprise a relatively narrow end portion which is shaped to extend into an opening through the mount and to allow the movement of the mount towards the surface of the first housing part, and a relatively wide portion between the end portion and the surface of the first housing part which is shaped to limit the movement of the mount towards the surface of the first housing part, for example by abutting the mount. The fact that, in this preferred embodiment of the invention, the or each support limits the amount of movement of the mount towards the surface of the first housing part has an advantage in that it can prevent the sealing material being put under too great a compression which could otherwise result in poor sealing performance. In addition, the supports may be shaped appropriately so that the mount may move towards the surface of the first housing part just the correct distance to provide the correct amount of displacement of the sealing material to form an optimum seal.

In a particularly preferred embodiment of the invention, the movement of the mount with respect to the first housing part to put the sealing material under compres-

sion is caused by bringing the first and second housing parts together. This has an advantage in that normally an effective seal is formed substantially automatically upon closing the housing of the device.

In one embodiment, the device according to the invention may have at least two parts, one of which is semi-permanently sealed such that access is only possible with special tools, and preferably only by the telephone company, and another part which can be opened by a subscriber in order to connect or disconnect his telephone or other equipment.

In another embodiment, the device may be formed such that the entire device can be opened by opening a single cover part to allow access to the electrical component(s) contained therein. Either embodiment of the devices may contain overvoltage and/or over-current protection circuitry.

Environmental protection may be provided by a suitably shaped housing, preferably in conjunction with a gel, mastic, adhesive or other suitable sealing material. We prefer that a gel be used, and preferably a material characterised by a cone penetration value (according to ASTM D217) of at least 50 (10^{-1} mm), more preferably at least 100 (10^{-1} mm), even more preferably at least 150 (10^{-1} mm) and preferably no greater than 400 (10^{-1}), especially no greater than 350 (10^{-1} mm). Preferably the gel has a hardness at room temperature as determined using a Stevens-Volland Texture Analyser of greater than 45g, particularly greater than 50g especially greater than 55g, e.g. between 55g and 60g. It preferably has a stress-relaxation of less than 12%, particularly less than 10% and especially less than 8%. Ultimate elongation, also at room temperature, is preferably greater than 60%, especially greater than 1000%, particularly greater than 1400%, as determined according to ASTM D638. Tensile modulus at 100% strain is preferably at least 1.8 MPa more preferably at least 2.2 MPa. In general compression set will be less than 35%, especially less than 25%. The material preferably also has a maximum tensile strength of approximately 20 p.s.i (1.4×10^5 N m $^{-2}$), and preferably a cohesive strength greater than its adhesive strength. The gel may comprise, for example, silicone gel, urea gel, urethane gel, or any suitable gel or gelloid sealing material. Preferred gels comprise an oil-extended polymer composition. Such gels are preferably pre-cured (which term, in the case of block copolymers and other such materials, includes the physical rather than chemical formation of a three-dimensional structure) before the gel is displaced into contact with the component that it is to protect. Such materials, and their method of use, are disclosed in, for example, US 4600261, and US 4634207.

The polymer composition of the gel may for example comprise an elastomer, or a block copolymer having relatively hard blocks and relatively elastomeric blocks. Examples of such copolymers include styrene-diene block copolymers, for example styrene-butadiene or styrene-isoprene diblock or triblock copolymers, or sty-

rene-ethylene-butylene-styrene triblock copolymers as disclosed in international patent publication number WO88/00603. Preferably, however, the polymer composition comprises one or more styrene-ethylene-propylene-styrene block copolymers, for example as sold under the Trade Mark 'Septon' by Kuraray of Japan. The extender liquids employed in the gel preferably comprise oils conventionally used to extend elastomeric materials. The oils may be hydrocarbon oils, for example paraffinic or naphthenic oils, synthetic oils for example polybutene or polypropene oils, and mixtures thereof. The preferred oils are mixtures of non-aromatic paraffins and naphthenic hydrocarbon oils. The gel may contain additives such as moisture scavengers (e.g. Benzoyl chloride), antioxidants, pigments and fungicides.

From the above description it is to be understood that device according to either aspect of the invention preferably provides environmental protection for at least one electrical component on a mount, preferably in the form of a circuit board, e.g. a printed circuit board, by means of gel, especially in the form of a layer of gel covering substantially the entire internal surface of the first housing part (or at least that portion of the first housing part which can be opened by the telephone subscriber). The circuit board or other mount is preferably moved towards the internal surface of the first housing part automatically upon closing the device with the second housing part, thereby displacing some of the gel to form a bead around at least part (preferably all) of the circuit board between the circuit board and a wall of the first housing part. The circuit board is preferably prevented from moving towards the internal surface of the first housing part by more than a preselected amount by means of one or more supports projecting from the internal surface, which preferably project through the gel and through one or more openings in the circuit board.

The invention is further illustrated, by way of example, with reference to the accompanying drawings, in which:

Figure 1 shows a device according to the invention in the form of a network termination module in perspective view with its cover closed;
 Figure 2 shows a similar module with its cover open;
 Figures 3 to 8 show various sectional views of the module of figures 1 and 2;
 Figures 9 and 10 show perspective views of another form of device according to the invention.

A module of figure 1 comprises a base (or first housing part) 1 which may be attached to a wall, and a semi-permanently attached first cover 2, and a removable second cover 3 (or second housing part).

In figure 2 the removable cover 3 is shown partially removed. The cover 3 has fixing means 19 which allow it to be slid or rotated with respect to the first cover 2. For example means 19 may slide within a channel 20 of cover 2. In the embodiment illustrated the means 19,

when cover 3 is closed, protects screw holes 21 by means of which the base 1 may be secured to a wall.

A gel material may be provided within means 19 and also around the periphery of the base or around the periphery of each cover in order that the module may be properly sealed when the covers are closed.

Various sectional views are shown in figures 3 to 6.

In figure 7 the base or first housing part 1 may be seen to carry a printed circuit board (P.C.B) 4 the underside of which is sealed by means of a gel 5. Edge portions of the gel 5 at positions 6 are displaced to provide beads 7 of gel around the periphery of the PCB between the PCB and a peripheral wall of the first housing part which beads 7 can seal to the cover 2 when the cover is forced in place. It can be seen that a gel is not needed above the P.C.B where the electronic components will be positioned. As a result the volume of gel required for total sealing is reduced.

We prefer that some disconnection mechanism be provided. When the second cover 3 is opened a switch or other means may be activated to disconnect subscriber wires from wires that lead to an exchange. Thus, line testing can be carried out to the subscriber or to the exchange independently, immediately the lid is opened.

The gel is preferably maintained under compression when the covers are closed, and such compression may result from positioning of the P.C.B firmly in place on the cover. In figure 7 it can be seen that movement of the P.C.B downwards (to the right as drawn) will place the gel 5 under compression and/or result in the beads 7 of gel being provided for sealing for the cover. The P.C.B. may be forced downwards by closing either or both of the covers.

Supports 10 for the P.C.B, which project from the internal surface of the base 1, each comprise a relatively narrow end portion 13 and a relatively wide base portion 14 between the end portion and the internal surface of the base. Each relatively narrow end portion extends into an opening in the P.C.B, but the P.C.B abuts against the relatively wide portion of each support, thereby preventing further compression of the gel between the P.C.B and the first housing part. It can be seen from Figure 7 that the bead 7 around the periphery of the P.C.B can be contacted by the cover 3 in order to form an environmental seal for the device when the device is closed.

Figure 8 shows a similar device to that of Figure 7, but in this case the construction of the wall 15 of the cover is slightly different to that of the cover of the device of Figure 7. In both devices, however, the cover contacts a displaced bead of sealing gel to form a seal and part of the cover contacts the P.C.B when the first and second housing parts are brought together, thereby automatically moving the P.C.B closer to the internal surface of the base (first housing part) and compressing the gel.

Figure 9 shows, in perspective, another device according to the invention, which is formed as a first housing part or base 8 and a second housing part or cover 9 which may be separated (as shown) to allow access

to the entire interior of the device. In this embodiment of the invention, there are four supports 10 for a printed circuit board each located generally in a corner of the rectangularly shaped base 8. As with the previously shown device, each support has a relatively narrow end portion which is shaped to extend into an opening in the circuit board and to allow some movement of the circuit board towards the internal surface 11 of the base which, in use, is provided with a layer of gel sealing material, so that the gel is compressed between the circuit board and the internal surface 11. Each support 10 also has a relatively wide portion between the narrow end portion and the internal surface of the base which is shaped to abut the circuit board to prevent further movement of the circuit board towards the base's internal surface, thereby substantially preventing over-compression of the gel.

Figure 9 also shows an opening 15 in the base 8. This opening is for a bolt for securing the circuit board to the base 8. In addition, Figure 9 shows openings 16 to allow a wire or cable (e.g. a telephone wire) to extend through the device, the openings being mated with semi-circular portions 17 to grip a cable or wire positioned therein in use.

Figure 10 shows the device of Figure 9 closed. Side portion 18 comprises part of a latching mechanism which releasably secures the base and the cover together. The opening 15 of the circuit board bolt can be seen on the underside of the base.

Claims

1. A device for environmental protection of an electrical component on a mount, which comprises: a first housing part (1,8), a second housing part (3,9) which together with the first housing part provides a closed housing; a mount (4) for an electrical component, that may be movably secured with respect to the first housing part; and a sealing material (5) positioned between the mount and a surface of the first housing part such that the mount can be moved with respect to the first housing part to put the sealing material under compression and to cause displacement of the sealing material to a position where it can form a seal between the first and second housing parts.
2. A device according to claim 1, in which the displacement of the sealing material (5) comprises formation of a bead of sealing material between a wall of the first housing part (1,8) and the mount (4).
3. A device according to claim 1 or claim 2, which further comprises one or more supports (10) for the mount (4), which project from the said surface of the first housing part (1,8), the supports being constructed to allow the mount to be moved towards the said surface of the first housing part to put the

- sealing material under compression.
4. A device according to claim 3, which further comprises one or more stop means (14) to limit the movement of the mount (4) towards the said surface of the first housing part (1,8).
5. A device according to claim 4, in which each support (10) comprises a relatively narrow end portion (13) which is shaped to extend into an opening through the mount (4) and to allow the said movement of the mount with respect to the said surface of the first housing part (1,8), and a relatively wide portion (14) between the end portion and the said surface of the first housing part which is shaped to abut the mount to limit the movement of the mount towards the said surface.
6. A device according to any preceding claim, in which the mount (4) comprises a printed circuit board.
7. A device according to any preceding claim in which the movement of the mount (4) is caused by bringing the first (1,8) and second (3,9) housing parts together.
8. A device according to any preceding claim, in which the sealing material (5) comprises a gel.
- Patentansprüche**
1. Vorrichtung zum Schutz einer elektrischen Komponente an einer Halterung gegenüber der Umgebung, wobei die Vorrichtung folgendes aufweist:
- ein erstes Gehäuseteil (1, 8), ein zweites Gehäuseteil (3, 9), das gemeinsam mit dem ersten Gehäuseteil ein geschlossenes Gehäuse bildet;
 - eine Halterung (4) für eine elektrische Komponente, die in bezug auf das erste Gehäuseteil bewegbar befestigbar ist; und
 - ein Dichtmaterial (5), das zwischen der Halterung und einer Oberfläche des ersten Gehäuseteils derart positioniert ist, daß die Halterung in bezug auf das erste Gehäuseteil bewegt werden kann, um das Dichtmaterial unter Kompression zu bringen und um eine Verdrängung des Dichtmaterials in eine Position zu bewirken, in der es eine Abdichtung zwischen dem ersten und dem zweiten Gehäuseteil bilden kann.
2. Vorrichtung nach Anspruch 1, wobei die Verdrängung des Dichtmaterials (5) die Ausbildung eines Dichtmaterialwulstes zwischen einer Wand des ersten Gehäuseteils (1, 8) und der Halterung (4) aufweist.
3. Vorrichtung nach Anspruch 1 oder Anspruch 2, die ferner ein oder mehrere Stützelemente (10) für die Halterung (4) aufweist, die von der genannten Oberfläche des ersten Gehäuseteils (1, 8) vorspringen, wobei die Stützelemente so ausgebildet sind, daß sie es ermöglichen, daß die Halterung in Richtung zu der genannten Oberfläche des ersten Gehäuseteils bewegt wird, um das Dichtmaterial unter Kompression zu bringen.
4. Vorrichtung nach Anspruch 3, die ferner eine oder mehrere Anschlageinrichtungen (14) aufweist, um die Bewegung der Halterung (4) in Richtung zu der genannten Oberfläche des ersten Gehäuseteils (1, 8) zu begrenzen.
5. Vorrichtung nach Anspruch 4, wobei jedes Stützelement (10) folgendes aufweist:
- einen relativ schmalen Endbereich (13), der so geformt ist, daß er sich in eine Öffnung durch die Halterung (4) erstreckt und die genannte Bewegung der Halterung in bezug auf die genannte Oberfläche des ersten Gehäuseteils (1, 8) ermöglicht, und
 - einen relativ breiten Bereich (14) zwischen dem Endbereich und der genannten Oberfläche des ersten Gehäuseteils, der so geformt ist, daß er an der Halterung anliegt, um die Bewegung der Halterung in Richtung zu der genannten Oberfläche zu begrenzen.
6. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei die Halterung (4) eine gedruckte Leiterplatte aufweist.
7. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei die Bewegung der Halterung (4) dadurch bewirkt wird, daß das erste (1, 8) und das zweite (3, 9) Gehäuseteil zusammengebracht werden.
8. Vorrichtung nach einem der vorhergehenden Ansprüche, wobei das Dichtmaterial (5) ein Gel aufweist.
- Revendications**
1. Dispositif pour la protection contre l'environnement d'un composant électrique sur une monture, qui comporte : une première partie de boîtier (1, 8), une seconde partie de boîtier (3, 9) qui constitue, avec la première partie de boîtier, un boîtier fermé ; une monture (4) pour un composant électrique, qui peut être montée de façon mobile par rapport à la pre-

mière partie du boîtier ; et une matière (5) d'étanchéité positionnée entre la monture et une surface de la première partie du boîtier afin que la monture puisse être déplacée par rapport à la première partie du boîtier pour placer la matière d'étanchéité sous compression et pour provoquer un déplacement de la matière d'étanchéité vers une position dans laquelle elle forme un joint étanche entre les première et seconde parties du boîtier.

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2. Dispositif selon la revendication 1, dans lequel le déplacement de la matière d'étanchéité (5) comprend la formation d'un bourrelet de matière d'étanchéité entre une paroi de la première partie (1, 8) du boîtier et la monture (4).

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3. Dispositif selon la revendication 1 ou la revendication 2, qui comporte en outre un ou plusieurs supports (10) pour la monture (4), lesquels font saillie de ladite surface de la première partie (1, 8) du boîtier, les supports étant réalisés de façon à permettre à la monture d'être déplacée vers ladite surface de la première partie du boîtier pour placer la matière d'étanchéité sous compression.

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4. Dispositif selon la revendication 3, qui comporte en outre un ou plusieurs moyens d'arrêt (14) pour limiter le mouvement de la monture (4) vers ladite surface de la première partie (1, 8) du boîtier.

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5. Dispositif selon la revendication 4, dans lequel chaque support (10) comporte une partie extrême relativement étroite (13) qui est configurée pour pénétrer dans une ouverture traversant la monture (4) et pour permettre ledit mouvement de la monture par rapport à ladite surface de la première partie (1, 8) du boîtier, et une partie relativement large (14) entre la partie extrême et ladite surface de la première partie du boîtier, qui est configurée pour porter contre la monture afin de limiter le mouvement de la monture vers ladite surface.

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6. Dispositif selon l'une quelconque des revendications précédentes, dans lequel la monture (4) comporte une plaquette à circuit imprimé.

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7. Dispositif selon l'une quelconque des revendications précédentes, dans lequel le mouvement de la monture (4) est provoqué en rapprochant l'une de l'autre les première (1, 8) et seconde (3, 9) parties du boîtier.

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8. Dispositif selon l'une quelconque des revendications précédentes, dans lequel la matière d'étanchéité (5) comprend un gel.

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Fig.1.

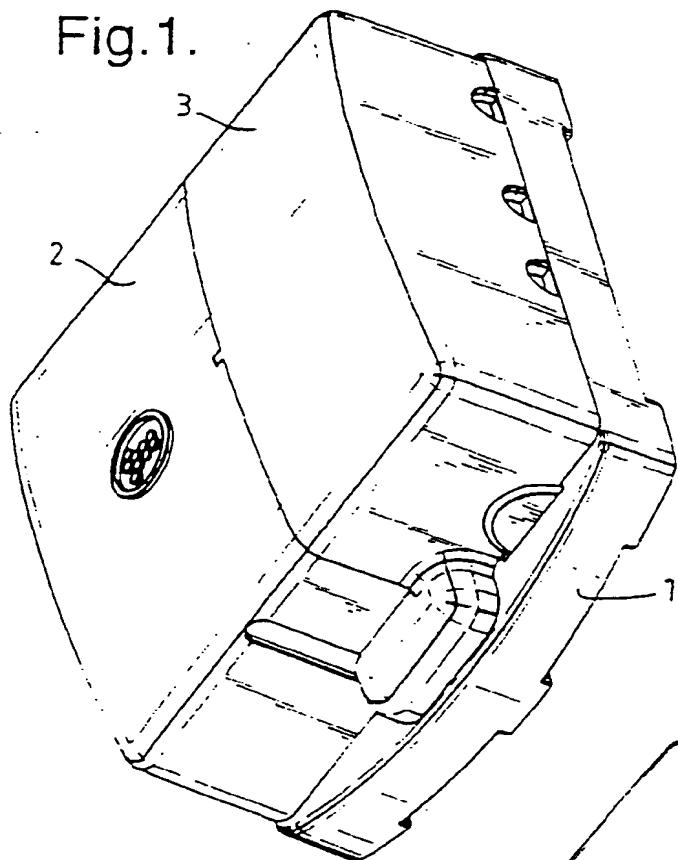


Fig.2.

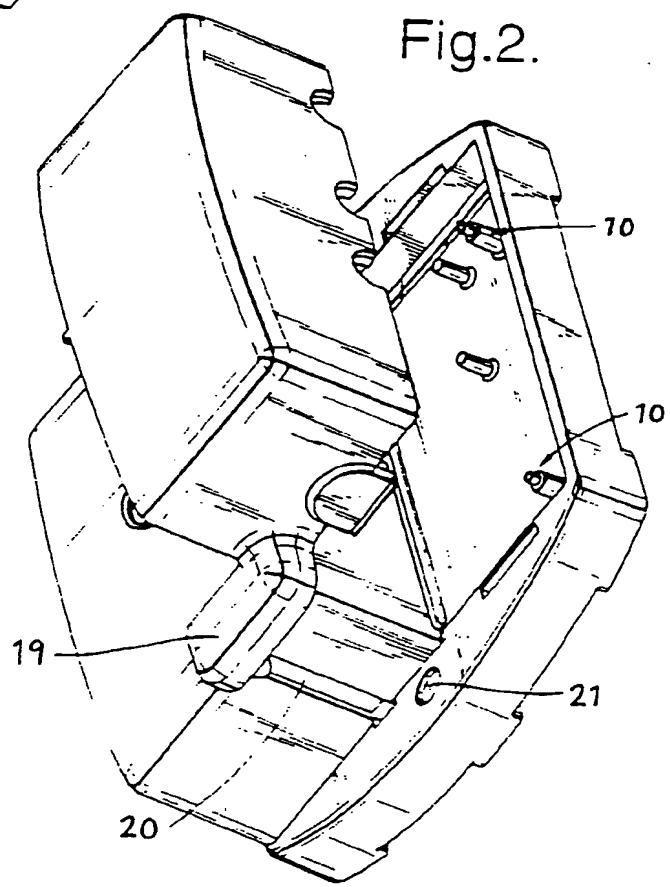


Fig.3.

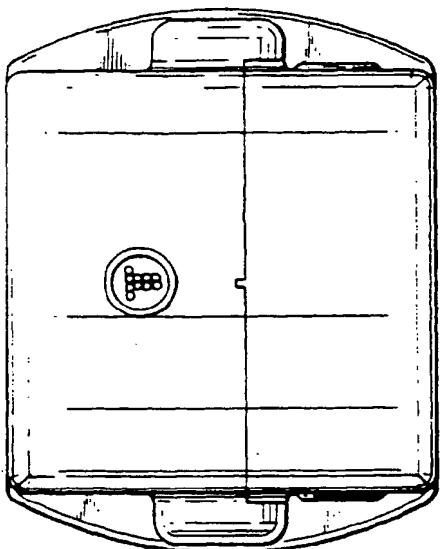


Fig.4.

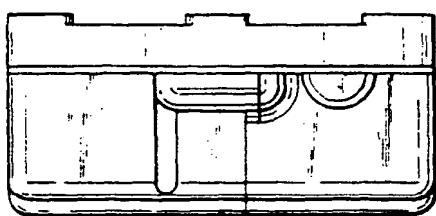


Fig.5A.

B →

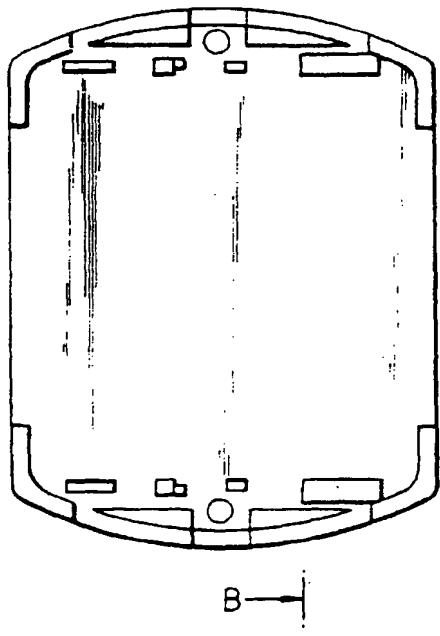


Fig.5B

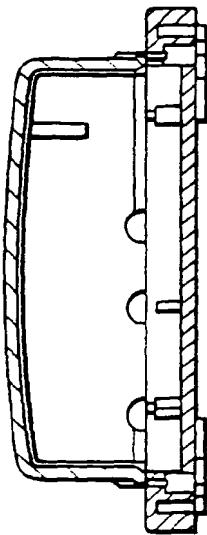


Fig.6A.

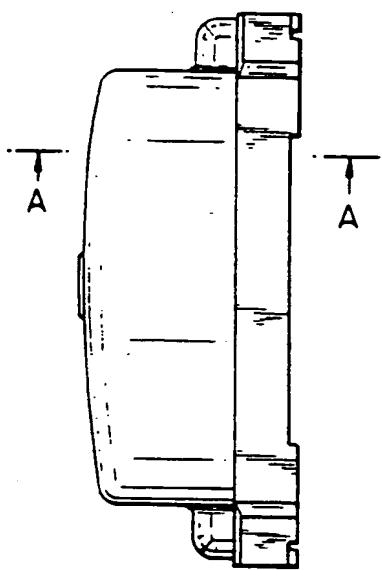
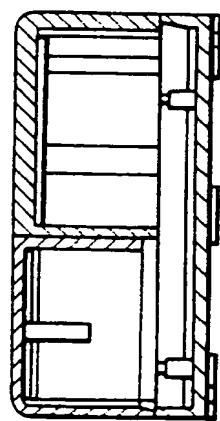


Fig.6B.



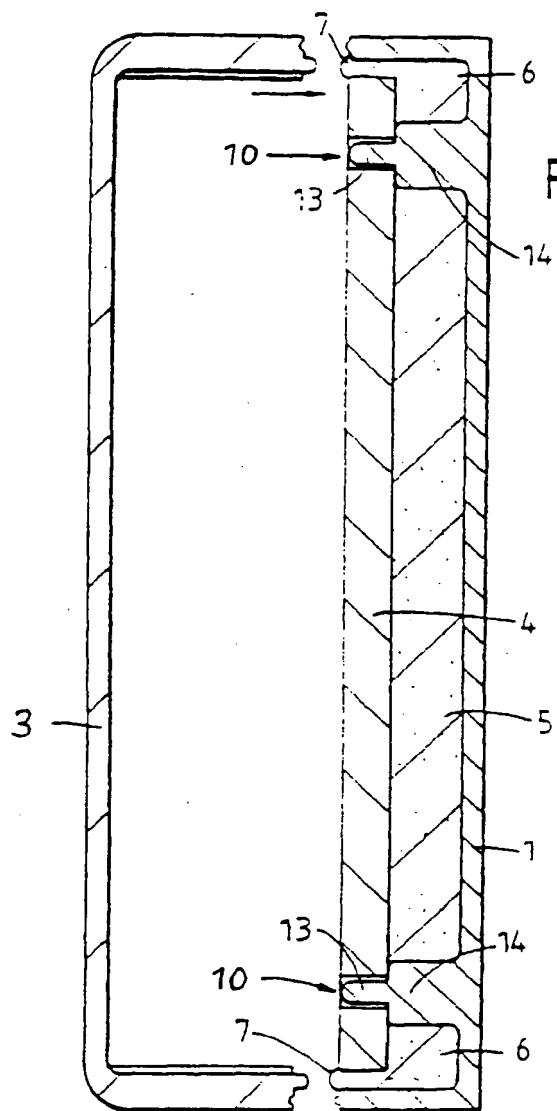


Fig.7.

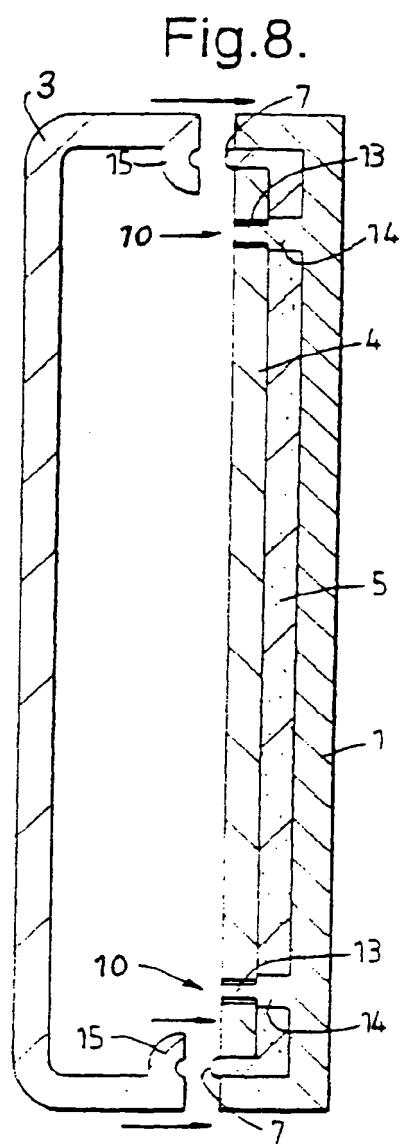


Fig.8.

Fig.9.

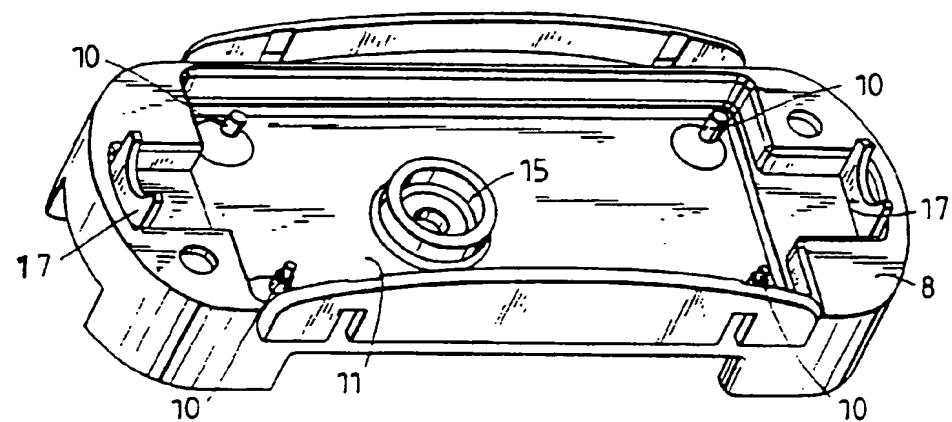
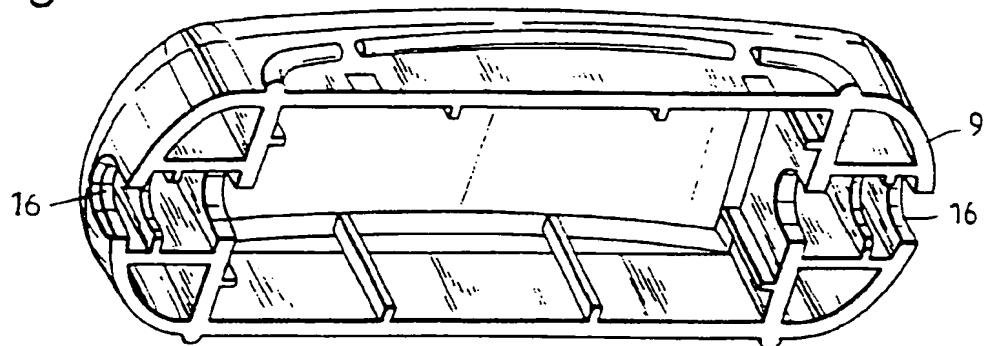
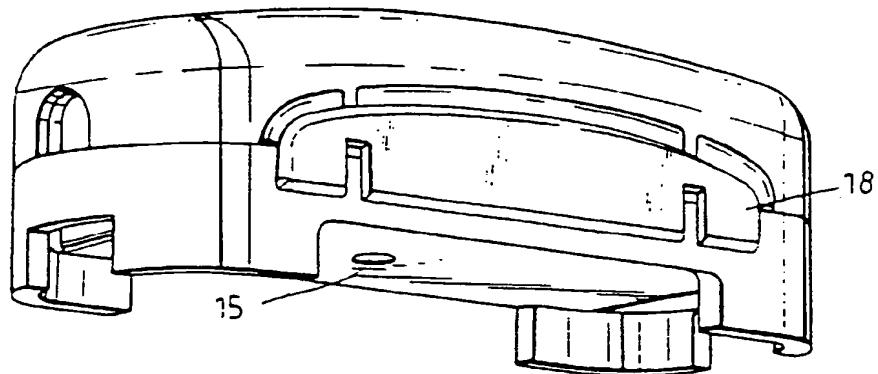


Fig.10.



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